## REMARKS/ARGUMENTS

This case has been carefully reviewed in view of the Official Action dated 18 October 2005.

In the Official Action, Claims 1 – 13 and 18 – 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kaplan et al., U.S. Patent 5,932,119 in view of Mourou et al., U.S. Patent 5,656,186.

Prior to discussion of the prior art references cited by the Examiner and the distinctive features of the present invention over the prior art, it is believed that a brief discussion of the novel concept underlying the present invention will facilitate the prosecution of the present Patent Application. The present invention is a method and system for a laser marking a gemstone which uses a laser pulse generated and scanned relative to the gemstone in accordance to a predetermined path defining the contour of indicia to be marked, wherein the laser pulse has a predetermined pulse duration selected to attain the best preciseness and the optimum condition for the polarization of the gemstone material. The duration of the pulse is approximately one nanosecond or less, as presented on page 1, lines 10 and 12, as well as on page 3 line 5 of the original Patent Application.

Kaplan et al., the main reference cited by the Examiner, is directed to a laser marking system for machining gemstones which includes generating a laser pulse, focusing the laser pulse onto the surface of a gemstone, displacing the surface of the gemstone with respect to the focused laser pulse in order to micro-inscribe alpha/numeric

characters on the girdle of diamonds.

It is respectfully submitted that nowhere in the Kaplan et al. Patent, is there any reference to a laser pulse duration.

Mourou et al., another reference cited by the Examiner is directed to a method for controlling configuration of laser induced breakdown and ablation. The method comprises generating a beam of laser pulses in which each pulse has a pulse width equal to or less than the predetermined laser pulse width value. The beam is focused to a point at or beneath the surface of the material where laser induced breakdown is desired. The threshold fluence as a function of laser pulse width is studied in the femtosecond range using a chirped-pulse amplification laser system. Such a function is examined for opaque material (such as, for example, gold), as well as for a transparent material (such as, for example, glass) to determine the laser induced breakdown threshold as a function of laser pulse bits between 150 fs-7ns.

It is respectfully submitted that Mourou et al. discusses two regimes of laser induced breakdown of materials: one - in which the threshold fluence increases as the square root of the pulse duration (this typically applies to pulses of duration greater than .01 nanoseconds); and another, in which the threshold fluence is relatively independent of pulse duration (typically applicable to pulses of duration .00001 to .01 nanosecond). Mourou et al. emphasizes and confines his claims to the second regime, which requires pulses of duration .01 nanosecond or less. It is readily known by those skilled in the art, that the lasers for producing this ultra short pulses are large, expensive and not practical

in the commercial sense.

It is respectfully submitted, that Mourou et al. fails to suggest the applicability of his principles to the process for laser marking a gemstone. The reference presents the applicability of the technique to the opaque material such as gold, and to a transparent material such as a glass ($Si0_2$). However, nowhere in Mourou et al. is it disclosed, suggested or rendered obvious that the technique can be used for marking gemstones.

Marking a diamond is a good example of the complexity of the marking process and is one of the most important application of laser marking of gemstones. High quality diamonds are characterized by a very low optical absorption at visible and near infrared laser wavelengths such as those generated by a YAG microchip laser described in the preferred embodiment of the subject Patent Application. At this wavelength, marking frequently must be initiated by coating the diamond surface with an optically absorbing material such as ink. The first laser pulse impingement on the diamond is absorbed by the surface coating and thermally convert a thin surface layer of the diamond to graphite. Second and successive pulses are absorbed by the graphite layer produced by the preceding pulse, vaporizing a portion of it and thermally converting a thin underlying layer of diamond to graphite. The critical step of diamond-to-graphite conversion requires the flow of heat from the laser-heated graphite to underlying diamond material. For the ultra short laser pulses of duration less than .01 nanoseconds taught by Mourou et al., there is effectively no time for heat flow and thermal conversion of diamond to graphite. It is Mourou et al., who correctly points out that, as the laser pulse duration

decreases, there is less time for heat flow into the diamond material, and thickness of the graphite layer must decrease. It is clear to those skilled in the art that the process underlying the subjecting of diamond to ultra short laser pulses is based on an entirely different physical process than the process of the present invention when the gemstones are subjected to laser pulses with a duration of approximately 1 nanosecond. Practitioners of the art using systems similar to those of Kaplan et al. would likely question the feasibility of laser marking with pulses of duration in the range presented in Mourou et al.

In contrast to Mourou et al, the present invention is directly aimed at the use of laser with pulse duration at approximately 1 nanoseconds for making gemstones.

The Examiner suggested that as Mourou et al. teaches a laser pulse less than 1 ns, it would be obvious to combine the Mourou et al. pulse duration with the Kaplan et al.'s system for marking the gemstone. It is however clear from the discussion presented in previous paragraphs, that not only Mourou et al. fails to suggest the usage of his invention for gemstone marking, but ultra short laser pulses in the range taught in Mourou et al. are simply not applicable to marking the gemstones, specifically the diamonds of Kaplan et al.

Anyone with experience in marking gemstones understands that achieving laser breakdown of the material is necessary but not sufficient for production of an acceptable quality mark. As outlined above, a person skilled in the art of diamond gemstone marking using the art taught by Kaplan et al., probably would be very skeptical of the

feasibility of diamond marking with laser pulses in the range taught by Mourou et al., since, as presented in previous paragraphs, there is simply no time for heat flow and thermal conversion of diamond to graphite with the ultra short pulses taught by Mourou et al.

The graphite layer produced by the first laser pulse also absorbs the following laser pulse and shields the interior of the diamond material from it. Absorption of laser light by defects in the bulk diamond material can lead to ablation in the bulk material. This results in the formation of chips or cracks in the gemstone, substantially reducing its value. As discussed above, the thickness of the protective graphite absorbing layer decreases with decreasing pulse duration. Although the ultra short pulses as taught by Mourou et al. would require less laser energy, they produce a thinner optical shield of the interior of the diamond, thus making the diamond susceptible to formation of the chips or cracks. Thus, usage of the ultra short pulses of Mourou et al. is undesirable in Kaplan et al.'s system, and these pulse durations are not combinable with the Kaplan et al.'s system as they may lead to production of diamonds of a low quality.

Absent Applicant's disclosure, there is no motivation for combining the use of ultra short laser pulses of Mourou et al. (which itself fails to apply the teachings to the marking gemstones and which is clearly not applicable to marking diamonds) with Kaplan et al. (which itself fails to teach a pulse duration, or correspondence between the pulse duration and the laser marking characteristics). It can only be thought an improper use of "hindsight", using Applicant's disclosure as a "blueprint" for the combination, that

the Examiner suggests such a combination of references, Mourou et al. with Kaplan et al.

Arguendo, even if teachings of the Mourou et al. are combined with Kaplan et al., it is believed that the combination of elements of the subject Patent Application, as now claimed, still provides patentable distinction over the structure resulting from the Examiner's suggested combination. As Claim 11, as amended, clearly directs itself to "A method of laser marking a gemstone ..." with " ... a laser pulse having a pulse duration of approximately 1 nanosecond ..." the combination which is not suggested, disclosed or rendered obvious neither in Mourou et al. nor in Kaplan et al., it is believed to be patentably distinct over the cited prior art, taken singly or in combination. Accordingly, Claim 11, as amended, is believed to be allowable; and the same is respectfully urged.

Claim 12, 13, and 18 – 20, directly or indirectly dependent upon Claim 11, are believed each to add further limitations that are patentably distinct in addition to being dependent upon what is now believed to be patentable base claim, and therefore, allowable for at least the same reasons.

For all of the foregoing reasons, it is now believed that the subject Patent Application has been placed in condition for allowance, and such action is respectfully requested.

Respectfully submitted,
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